

MISSISSIPPI SPR-1(46), PART II

GENERAL COMMENTS ON RESEARCH WORK PROGRAM
FOR FISCAL YEAR 2006

The SPR (Part II) research work program allocation for FY 2006 totals \$2,000,000 (estimated) and includes a National Cooperative Highway Research Program (NCHRP) contribution of \$440,000 (estimated) for FY 2006, a TRB Correlation Service contribution of \$93,455 and pooled-fund studies totaling \$430,000 as detailed in the program tabulation and narrative included in this document. The NCHRP funding is 5.5% of the total SPR allocation (Parts I and II). This work program tabulation also includes renewal statements for all on-going line items. The renewal statements for state studies contain financial information including total study budget, total expenditures to date, and cost estimates for fiscal year 2006. Also included in the renewal statements for state studies are narrative descriptions of study objectives, accomplishments of the past year, and work planned for fiscal year 2006. Beginning and completion dates are shown for each state study. Line items other than state studies have narrative descriptions of scope, objectives and anticipated activities along with a cost estimate. These tabulations and renewal statements constitute the FY 2006 research work program.

The pooled fund studies, TRB Correlation Service and NCHRP are funded with 100% SPR Part II funds (no state match). The twenty-eight line items in the tabulation mentioned above includes only those items for which there is a state match (80/20) in the funding.

State study numbers in this work program are the same as those currently being used, and they will remain the same in all correspondence. Study proposals for future submissions will be numbered sequentially.

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM 1

Long-Term Pavement Performance

This line item is for support of the Long-Term Pavement Performance (LTPP) program begun under the Strategic Highway Research Program (SHRP) and now a part of the Federal Highway Administration (FHWA). Activities covered include site nomination, site verification, historic data searches, support for material sampling and field-testing, construction supervision, and technology transfer activities associated with LTPP and SHRP product implementation.

Activities conducted in FY 2005 included:

- support for field data collection

Activities planned for FY 2006 include:

- maintaining pavement marking for existing LTPP sites
- support for all LTPP activities

Cost Estimate for FY 2006

Salaries (Regular Employees)	\$1,500
Employee Benefits	\$420
Materials, Supplies, and Services	\$380
Travel and Sustenance	<u>\$200</u>
Total	\$2,500

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM 2

Implementation of Research Projects

This line item funds Research Division activities relating to implementation of research studies.

Implementation Activities consist of field and office activities that apply research results to the solution of operational problems in the transportation area. Examples of these activities are:

1. Applying new products and/or procedures in the field to specific field problems.
2. Short-term field and/or office technical support in trouble-shooting and design.
3. Assistance in development of specifications and tests to implement new products or procedures.
4. Identifying areas in which research is required.
5. Initial preparation costs associated with proposed research.

Research information for implementation may originate from MDOT's Research Program (in-house and Contract), including both completed and ongoing studies; from other state transportation agencies' experiences and research; from national and international sources, from the FHWA; and from major research sources such as NCHRP, Corps of Engineers, etc.

Cost Estimate for FY 2006

Salaries (Regular Employees)	\$187,500
Employee Benefits	\$52,500
Materials, Supplies, and Services	\$15,000
Travel and Sustenance	<u>\$20,000</u>
Total	\$275,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM 3

Technology Transfer

This activity funds Research Division activities relating to the distribution of information about transportation technologies to any of MDOT Research Division's transportation customers.

There are many similarities between items falling under the categories **Technology Transfer** and **Implementation** of this work program. For the purposes of this work program, a distinction will be made that **Implementation** will be concerned with actively putting research results into practice while **Technology Transfer** will refer to efforts to disseminate information. Examples of technology transfer are:

- making presentations of research results to various groups such as universities and technical societies
- participation in user group meetings, conferences, seminars and training courses
- distribution of research results
- inputting research and research-in-progress (RIP) results into the Transportation Research Information Service (TRIS)
- maintaining Research Division intranet website and support for research related postings on MDOT's "GoMDOT" webpage.
- Producing and distributing a MDOT Research Newsletter twice annually

NOTE: The SPR WORK PROGRAM-PART I (Planning), Technology Transfer, provides direct support to the Center for Technology Transfer (T²) at Jackson State University, and those activities and funds are not included in the above line item, Technology Transfer.

Cost Estimate for FY 2006

Salaries (Regular Employees)	\$62,500
Employee Benefits	\$17,500
Materials, Supplies, and Services	\$6,000
Travel and Sustenance	\$12,000
Conference Registrations	<u>\$2,000</u>
Total	\$100,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM 4

Pavement Management

This item covers the activities of the Research Division relating to the development, implementation, maintenance and operation of the Department's Pavement Management System.

Activities include awareness of national pavement management state-of-the-art and practice, administration of field data collection and statewide database development, administration of pavement condition survey contracts, quality assurance for condition surveys, in-house software development, administration of contract software development, planning and conducting in-house training, administration of contract pavement management research, implementation of pavement management research and annual distress surveys associated with MDOT's maintained pavement projects.

Cost Estimate for FY 2006

Salaries (Regular Employees)	\$187,500
Employee Benefits	\$52,500
Materials, Supplies, and Services	\$15,000
Travel and Sustenance	<u>\$20,000</u>
Total	\$275,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 5	STATE STUDY NO. 133
TOTAL STUDY BUDGET: \$106,368	TOTAL STUDY COST TO DATE: \$99,475
DATE STARTED: 10/01/99	COMPLETION DATE: 12/31/05
STUDY TITLE:	Soil Stabilization Field Trial
RESEARCH AGENCY:	University of Mississippi (This study will be conducted jointly with the Portland Cement Association sharing costs)
PRINCIPAL INVESTIGATOR:	K.P. George

Objective:

A field trial is proposed to investigate the effectiveness of fly ash or other methods such as pre-cutting the base at regular intervals or pre-cracking in mitigating the shrinkage-cracking problem in soil-cement. The Department has been using lime-fly ash (LFA) for stabilization of bases, and this field study will compare the performance of cement sections with LFA included in the program.

The research study is proposed to have a field trial incorporating one section of cement, another of reduced cement and fly-ash, a third section with pre-cut cement layer, a fourth section with induced pre-cracking, a fifth section incorporating lime and fly-ash, and the last section with ground granulated blast furnace slag as an additive.

Progress:

A literature review has been performed to review any previous research that would relate to the study. A project was identified for the test sections on MS 302 in Marshall County. Samples of the select material from this project location obtained and laboratory tests performed. Mix designs for each test section were composed based on these laboratory test results.

Six test sections were constructed and samples molded from the field-mixed material for strength testing at 7, 14, 28 and 90 days. Moisture/density testing of the in-place material was performed at the time of construction. Geogauge, FWD (performed by MDOT) and Clegg hammer testing was performed, and crack surveys obtained, over a 28-day monitoring period prior to placement of the asphalt base course. Twenty eight-day field cores were also collected and tested for unconfined compressive strength. Backcalculations of pavement layer moduli from FWD deflection basins were performed and these results compared to Geogauge results. An interim report was published by the principal investigator.

First-year field monitoring, including deflection tests employing FWD, retrieving 4-inch diameter cores and a detailed crack survey was conducted. The MODULUS 5.1

Progress Continued:

computer program was used to analyze the FWD deflection data. Core samples were tested for UCS.

Interim Report III was submitted to MDOT.

Fourth-year crack surveys were completed.

The test sections were periodically inspected for surface cracks during FY 2004.

Fifth-year field tests including FWD tests, extraction of cores and performance of a crack survey were conducted for each of the test sections. FWD data was employed to backcalculate the modulus of layers, especially the stabilized base. Compressive strength of each stabilized base was determined by testing cylindrical cores.

The consultant was requested by MDOT to provide additional services related to this project resulting in an increase of \$9,092.00 to the total cost of the study. The backcalculation analysis was more complex than originally envisioned because the backcalculated moduli of some of the stabilized soil base course sections were smaller than that of the underlying lime-treated subgrade. This did not agree with field observations since the base course materials were of such quality that intact cores could be extracted for UCS testing, whereas intact cores could not be obtained from the lime-treated subgrade layer. In order to analyze this problem data, two other backcalculation routines were employed in the study. Numerous trial runs were performed resulting in the development of a special procedure using ELMOD to handle this type of problem.

As previously noted, intact cores could not be obtained from the lime-treated subgrade layer. In order to obtain an estimate of the condition and thickness of this layer dynamic cone penetrometer (DCP) tests were added to the study testing program. These tests were conducted in the holes following retrieval of the cores from the HMA and base layers.

The resulting test data was compared to those results obtained from earlier findings to make final conclusions as to the suitability of each stabilized material. Preparation of a draft of the final report was initiated.

Plans for FY 2006:

The final report will be completed and submitted to MDOT.

Cost Estimate for FY 2006 \$6,893

The PCA and the University of Mississippi are providing funds that are not reflected in this Work Program to supplement this effort.

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 6	STATE STUDY NO: 138
TOTAL STUDY BUDGET: \$75,000	TOTAL STUDY COST TO DATE: \$24,846
DATE STARTED: 10/01/99	COMPLETION DATE: 03/31/06
STUDY TITLE:	In-House Support to State Study No. 133
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

This study will be conducted to support State Study No. 133 "Soil Stabilization Field Trial" which is a proposed contract with the Department of Civil Engineering at the University of Mississippi. The field site location, layout, and sampling to support the contract study will be conducted by this in-house study.

Progress:

Federal Aid Project No. NH-0021-01(104)PH2 was selected as the project for the current study test sections. The project site is located on MS 302 between the Desoto/Marshall County line and US 72 in Marshall County. Meetings were conducted with the principal investigator of State Study No. 133, the Contractor/Subcontractors and MDOT personnel to ensure that the objectives of State Study No. 133 and the field methodologies utilized to meet these objectives were understood by all parties involved in the study. Samples of the select material from the project were obtained and submitted to the University of Mississippi for the required laboratory testing.

The construction of the various test sections was coordinated by MDOT and included a cement treated control section, cement treated with application of a vibratory roller, cement and fly-ash, lime-fly ash, ground granulated blast furnace slag, and a cement treated section precut at 10-ft. intervals. The Department's falling weight deflectometer (FWD) was utilized for testing of the subbase prior to placement of the first lift of asphalt. The final draft of the interim report, which included the construction of these test sections and testing performed in conjunction with this construction, was reviewed.

As part of the first-year field monitoring of the test sections, FWD testing was conducted in, and field cores obtained from, these sections. Interim Report II includes this phase of field monitoring and was reviewed.

As part of the third-year field monitoring of the test sections, FWD tests were performed.

Reviewed Interim Report III during FY 2004.

As part of the fifth-year field monitoring FWD tests were conducted and cores were extracted from the pavement test sections.

Plans for FY 2006:

Review the final report for SS No 133.

Cost Estimate for FY 2006 \$2,500

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 7	STATE STUDY NO. 144
TOTAL STUDY BUDGET: \$161,671	TOTAL STUDY COST TO DATE: \$138,352
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/06
STUDY TITLE:	Profilograph Specification Study
RESEARCH AGENCY:	Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	Milady Howard

Objective:

The current roughness specification utilized by the MDOT was developed over 10 years ago and there have been no significant changes since. The specification was developed based on the manual profilograph, which has since been replaced by the automatic unit. Also, unlike 10 years ago, industry is now utilizing high frequency rollers to compact their hot mix asphalt pavements. These rollers have a propensity for creating small scallops in the pavement surface, which due to the blanking band requirement in the current roughness specification are not taken into account when computing a profile index. However, these scallops are certainly felt by the traveling public and create a rougher ride quality. Based on the current specification, industry is not being penalized for a rough ride quality and in some instances contractors are being rewarded with incentive pays for a rough final ride surface. Most states have removed the blanking band from their roughness specification for this very reason. Many of the states have gone to the light weight profiler for their QC/QA of ride quality. The MDOT intends on utilizing the light weight profiler, which instead of producing a profile index value measures the International Roughness Index (IRI). This transition will take some time with undoubtedly a period of time where a dual specification (light weight profiler and profilograph) is in place. If the MDOT is to ever successfully make this transition, the current profilograph specification must be "tightened up" and data must be gathered comparing profile index values to IRI for Mississippi pavements.

Progress:

Roughness data has been gathered from approximately twenty (20) projects utilizing the "California type" profilograph, South Dakota type road profiler and the AARB walking profiler. Using this information the department has tentatively revised the current 907-403-12 and the 907-401-22 specifications with regards to surface smoothness. The major change involved in this proposed update is the removal of the .2" blanking band for Profile Index computation. The bump requirement has also been changed from .4" per 25' to .3" per 25' for all pavements.

The department has purchased a lightweight profiler capable of collecting both PI and IRI. Project funds were not utilized to purchase this equipment. Proof testing of the newly acquired lightweight profiler has begun.

Progress Continued:

Data was gathered from throughout the State on calibration sections to develop the new IRI specification. The data has been compiled to give an initial best fit correlation between current PI acceptance values and collected IRI values. This initial IRI acceptance correlation data was compared to IRI specifications in other states such as Texas and Virginia.

James Watkins initiated and is continuing development of a software package that will be capable of identifying bumps and dips, as well as being universal to all inertial profiler manufacturers.

Steve Karamihas from the University of Michigan Transportation Institute visited with MDOT Research and Construction Division staff members to assist with the ongoing research effort.

Data was gathered from throughout the State on new construction projects.

During FY 2005 some data was collected using both the AMES Profilograph and the ICC Lightweight Profiler.

Plans for FY 2006:

The ICC Light-Weight Profiler will be calibrated on all of the MDOT certification sites and an evaluation will be made as to whether MDOT can use this device instead of the profilograph to certify the contractor's equipment.

The latest version of Proval will be tested to determine if the project offices and contractors can use it when the Department changes to an IRI based specification.

Data will be collected on new construction projects and used in the new IRI specification. Based on the results of this evaluation the new IRI specification will be piloted on a few construction projects in the spring/summer of 2006.

Data will also be collected to determine a minimum lead in and out distance for the Light-Weight Profiler on bridges.

Cost Estimate for FY 2006 \$23,319

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 8	STATE STUDY NO: 157
TOTAL STUDY BUDGET: \$150,000	TOTAL STUDY COST TO DATE: \$111,425
DATE STARTED: 03/01/02	COMPLETION DATE: 09/30/06
STUDY TITLE:	Evaluation of DRM System
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Randy Battey

Objective:

Reflective cracking in flexible pavements is a primary form of distress found in Mississippi highway pavements. To date, few if any, fail safe preventative measures to prevent this distress have been discovered.

The objective of this project is to evaluate an interlayer system, DRMTM (Distress Resistant Membrane), as a preventative treatment for reflective cracking in HMA pavements. (More information on the DRMTM system can be found at <http://www.highwaypreservation.com>) A seven mile long project on MS4 near the community of Galena in Marshall County will be utilized for the evaluation. MS4 near Galena was originally constructed in 1981 and is comprised of 6" of asphalt pavement on top of a soil cement base. Reflective cracking from the soil cement base has caused the pavement condition to become unacceptable.

The study will compare 3½ miles of DRMTM with a subsequent 4" overlay to 3½ miles of no DRMTM with a 4" overlay. A comparison will be made between the amount of reflective cracking in the new 4" overlay between the sections with and without the DRMTM system.

Progress:

The performance of the sections continued to be monitored in FY 05.

Plans for FY 2006:

Continue monitoring the performance of the DRM test sections by collecting IRI, PCR and video data. Prepare the final report documenting the performance of the test sections.

Cost Estimate for FY 2006 \$2,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 9	STATE STUDY NO: 166
TOTAL STUDY BUDGET: \$110,000	TOTAL STUDY COST TO DATE: \$58,946
DATE STARTED: 10/01/02	COMPLETION DATE: 12/31/06
STUDY TITLE:	Hot Mix Asphalt (HMA) Characterization for the 2002 AASHTO Design Guide
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Tom White

Objective:

MDOT currently uses the AASHTO Guide for the Design of Pavement Structures for structural pavement design. This guide is empirically based and utilizes the concept of structural numbers (SN) to determine the overall required thickness of varying pavement layers. These structural numbers were determined from the AASHTO road test in the 1950's.

Currently the AASHTO 2002 Guide for Design of New and Rehabilitated Pavement Structures is being developed. This guide will have three design levels (Level 1,2 and 3) all based on mechanistic-empirical design principles and will potentially replace the existing guide as the structural design guide for MDOT.

The researchers working on the flexible pavement component of the 2002 guide have evaluated many test methods to determine the best relationship between observed HMA mix lab performance and field performance with respect to rutting, fatigue cracking, etc. Currently, the dynamic modulus test will be used to characterize HMA mixes for input into the 2002 design guide. The test is run in accordance with ASTM D 3497 Standard Test Method for Dynamic Modulus of Asphalt Concrete Mixtures.

Mississippi HMA mixes need to be characterized using dynamic modulus testing in preparation for the future implementation of the 2002 design guide. In this study a range of HMA mixes will be characterized using the dynamic modulus testing. Any proposed evaluation will initially be focused on materials and mixes that are currently being used in the state.

Selected mixes will also be evaluated using the asphalt pavement analyzer (APA) and confined repeated deformation testing for comparison purposes. MDOT has performed APA testing on many mixes and a side-by-side comparison of the dynamic modulus and the APA would be very useful.

Progress:

A determination was made regarding which HMA mix design variables to include in the study. Discussions were made with personnel from NCAT, the University of Arkansas and Advanced Asphalt Technologies regarding the testing equipment and protocols used for dynamic modulus testing.

Appropriate literature involving the dynamic modulus test and the 2002 design guide was obtained and reviewed and mix design work was conducted during FY 2004.

Mix design work was performed.

Final purchase arrangements for the necessary testing equipment were made during August 2004.

During FY 2005 sample coring was conducted to determine an appropriate procedure for test specimen preparation and a new saw was procured to cut the ends of the cored specimens. Sawing is required to ensure that the two ends of each core meet the tolerance as parallel planes. Additional stockpile materials were obtained and stored. Tests for all materials and mix designs were completed.

Bids were received for the procurement of the required servohydraulic testing equipment. The bids exceeded the anticipated costs, therefore, it was decided to refine the bid specifications and re-advertise. New bids were received and one of the bids was selected for this new equipment. The bid and supporting documentation was submitted to IHL for approval. Approval was granted in June, 2005 with an anticipated equipment delivery date of October 1, 2005.

The graduate student working on the project is leaving MSU. In preparation for that a new graduate student has been recruited. The new student worked with the outgoing student to become familiar with all material tests and mix design steps. Provisions were made for this new student to visit a laboratory with similar test equipment and observe or assist in tests of the type being utilized in the current project.

Plans for FY 2006:

The new test equipment installation will be completed and training on its use will be conducted. Tests of typical HMA in Mississippi will be completed and the results reported.

Cost Estimate for FY 2006 \$51,054

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 10

STATE STUDY NO: 170

TOTAL STUDY BUDGET: \$307,163 (SP&R)	TOTAL STUDY COST TO DATE: \$0 SP&R
<u>\$500,000 (Non SP&R)</u>	<u>\$163,101 Non-SP&R</u>
\$807,163 Total	\$163,101 Total

DATE STARTED: 03/01/04

COMPLETION DATE: 03/01/08

STUDY TITLE:

Implement the 2002 Design Guide for MDOT
(Phase II)

RESEARCH AGENCY:

ERES Consultants Division of ARA, Inc.

PRINCIPAL INVESTIGATOR:

Athar Saeed

Objective:

ERES Consultants Division of Applied Research Associates, Inc. is finalizing the development of the 2002 Guide for Design of New and Rehabilitated Structures through NCHRP Project 1-37A. The 2002 Guide incorporates mechanistic-empirical pavement design principles and allows highway agencies to develop cost-effective and reliable designs by systematically considering climate, material properties, construction variability, and traffic to predict pavement performance. This design process is a total departure from the process utilized in the current AASHTO design procedure, requiring the designer to make trial selection of materials and layer thicknesses and evaluating their performance under projected loadings over the design life of the pavement.

The objective of this study is to implement the 2002 Design Guide for Mississippi DOT. The following issues will be addressed in this study:

- Provide for training of Design Guide users and other stakeholders
- Develop and execute a plan for securing the appropriate design input data on material and traffic characterization, and other design inputs
- Conduct sensitivity analyses and make comparisons of 2002 designs with current procedure
- Develop and execute a plan for calibration of Guide performance and distress models

Progress:

- A technical memorandum describing the ME PDG inputs for new and rehabilitated pavement design was submitted to Mississippi DOT.
- A three-day meeting was held with Mississippi DOT personnel from July 12 through July 14, 2004 to discuss and review PDG inputs.

Progress Continued:

During FY 05 work on project tasks was slowed at MDOT's request in anticipation of recommendations from NCHRP Project 1-40 which is reviewing NCHRP 1-37A deliverables. However, work continued, especially on those tasks not affected by NCHRP 1-40. The following tasks have either been completed or progress made during this FY:

- Preliminary sensitivity analysis is completed
- Completed establishment of materials and traffic estimation procedures and default values
- Progress made on performing detailed sensitivity analysis of Design Guide software
- Progress made on setting up a laboratory and field testing program
- Progress made on finalizing the selection of pavement sections for use in calibrating/validating the design guide performance models
- Progress made on preparing a Phase II Interim report that documents the research results for FYs 04 and 05 and will provide a detailed research plan for the next 24 months.

Plans for FY 2006:

- Continue setting up laboratory and field testing program
- Complete selection of pavement sections for calibrating/validating design guide performance models
- Submit Phase II Interim Report
- Begin assembling data for calibration/validation of performance models
- Begin backcalculation of FWD data obtained from rehabilitated pavement sections
- Begin calibration/validation of performance models

Cost Estimate for FY 2006 \$94,011 SP&R
\$211,899 Non SP&R

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 11	STATE STUDY NO: 171
TOTAL STUDY BUDGET: \$200,000	TOTAL STUDY COST TO DATE: \$40,308
DATE STARTED: 03/01/04	COMPLETION DATE: 03/01/08
STUDY TITLE:	In-House Support to State Study 170
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

This study will be conducted to support the proposed study "Implement the 2002 Design Guide for Mississippi DOT." The construction, traffic and materials data will be obtained for approximately 132 existing pavement sections. In addition to this data, pavement coring and FWD testing will be required for 24 of these pavement sections. Coordination between the six District Materials Engineers, the MDOT Central Laboratory and the private testing firm will be required to ensure that the requisite materials testing is conducted on representative samples of subgrade soils, crushed rock base course materials and chemically stabilized soil materials. Review the input/output data related to the customized 2002 Design Guide software as well as the developed training materials including courses, seminars and manuals that will be delivered to MDOT as a result of the referenced study.

Progress:

The PI of SS No. 170, the MDOT Technical Advisory Committee members and PIs of support studies were coordinated to facilitate the implementation of the new MEPDG.

The technical memorandum provided by the PI of SS No 170 was reviewed and the NHI Course No. 131064 "Introduction to Mechanistic-Empirical Pavement Design" workbook was reviewed for general background regarding the new MEPDG and material property and traffic inputs for the new design procedure.

A list of roads was supplied to ERES Consultants to be reviewed as candidates for the test sections to be included in the factorial experiment design.

During FY 2005 pavement performance data was provided to the principal investigator of SS No. 170 for numerous pavement sections located throughout the state. Collection of requisite MDOT construction and materials data for several of these pavement sections was performed and the data submitted to the principal investigator. Several coordination meetings were held to support this data retrieval and submission process.

Plans for FY 2006:

Continue coordination activities and review Phase II Interim Report. Continue process of collecting requisite MDOT data for calibration of performance models. Perform FWD testing and coring operations on rehabilitated pavement sections selected for calibration/validation of performance models.

Cost Estimate for FY 2006 \$50,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 12	STATE STUDY NO: 173
TOTAL STUDY BUDGET: \$90,000	TOTAL STUDY COST TO DATE: \$25,000
DATE STARTED: 10/01/03	COMPLETION DATE: 09/30/08
STUDY TITLE:	Evaluation of Preventive Maintenance Treatments
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Randy L. Battey

Objective:

Preventive maintenance is the planned treatment of pavements which provides protection, decreases the rate of deterioration and adds 5 to 10 years to the service life of the pavement. Agencies must determine which of the many treatments that are available provides the most benefit for the various stages of a pavements life. In this study an evaluation will be performed of two seal treatments to provide cost/benefit data and assist in the updating of Mississippi DOT's "decision trees" that are utilized to determine which preventive maintenance treatment provides the most benefit for each pavement condition.

Progress:

The initial project evaluating a scrub seal treatment was constructed on MS 35 in Tallahatchie County from logmile 18.773 to 19.773 was constructed in March of 2005. Distress and smoothness measurements were taken both before and after construction. A second location to evaluate a microsurfacing treatment was identified on US 61 in Tunica County. This second location had pre-rehabilitation distress and smoothness measurements performed.

Plans for FY 2006:

Periodic distress and smoothness measurements will be made on both of the project locations. The feasibility of incorporating a third evaluation into this project will be explored.

Cost Estimate for FY 2006 \$15,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 13	STATE STUDY NO: 175
TOTAL STUDY BUDGET: \$92,222	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/06
STUDY TITLE:	Effectiveness of Increased Highway Patrol Surveillance on Work Zone Safety in Mississippi
RESEARCH AGENCY:	The University of Southern Mississippi
PRINCIPAL INVESTIGATOR:	Tulio Sulbaran & David Marchman

Objective:

Among the MDOT work zone safety initiatives, MDOT has established an agreement with the Mississippi Highway Patrol (MHP). As part of the agreement, MDOT has provided funds to the MHP to increase surveillance in high profile work zones. The objective of this project is to evaluate the safety impact of this increased surveillance. This will be achieved by the following means:

- Collecting historical and field data from selected Mississippi work zones before, during and after the increased highway patrol surveillance
- Reviewing nationwide literature of increased highway patrol surveillance in work zones
- Analyzing the compiled Mississippi data and the nationwide literature search findings

The data collection in Mississippi work zones will begin by consolidating MDOT and other government entities historical data. The data consolidation will include:

- Characteristics of work zones (i.e. locations, safety programs, conditions before, during and after construction)
- Traffic parameters (such as traffic volume before, after and during construction)
- Accident information (location, time, severity and cause of accident)

Once the historical consolidation has been performed, similar information will be gathered on projects currently under construction.

Ultimately correlations will be established to relate traffic parameters such as volume and speed to accidents in work zones. A second correlation between increased highway patrol surveillance, traffic parameters and accident rate will be established. Using these correlations the impact of increased highway patrol surveillance on accident reduction will be identified.

Progress:

Progress during FY 05 includes:

- A literature search was performed to review previous work of the effect of increased highway patrol surveillance on work zone safety.
- Established highway patrol surveillance effectiveness measurement criterion and variables for Mississippi based on the literature review.
- Interacted with MDOT to select highway work zones to be used for this project and completed the compilation of information regarding several Mississippi work zone projects.
- Obtained MDOT approval for the specific study parameters.
- Obtained access to Mississippi historical data regarding work zones, traffic parameters and accident data.
- Analyzed current traffic parameter and incident/crash data
- Made initial correlation based on current data and identified need for collection of additional data.
- Identified field plan to collect data

Plans for FY 2006:

- Continue correlation analyses to evaluate relationships between traffic parameters such as volume and speed versus accidents in the work zones, and between increased highway patrol surveillance and traffic parameters.
- Establish links between increased highway patrol surveillance implemented by MDOT on Mississippi highways and accident reduction
- Compare Mississippi findings with the nationwide findings
- Write final report

Cost Estimate for FY 2006 \$92,222

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 14	STATE STUDY NO: 177
TOTAL STUDY BUDGET: \$89,808	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/06
STUDY TITLE:	Inputs of Portland Cement Concrete Parameters Needed for the Design of New and Rehabilitated Pavements in Mississippi
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	Ahmed Al-Ostaz

Objective:

MDOT is implementing the mechanistic-empirical pavement design methodology developed under NCHRP 1-37A. This pavement design method characterizes the pavement materials by fundamental properties such as modulus and Poisson's Ratio. For rigid pavement design the Portland Cement Concrete (PCC) is characterized by:

- Modulus of Rupture
- Compressive Strength
- Modulus of Elasticity
- Tensile Strength
- Coefficient of Thermal Expansion
- Concrete Shrinkage
- Unit Weight
- Poisson's Ratio

In this study PCC mixes encompassing a range of aggregate types with various blends of Type I cement, Class F or C fly ash and slag that are typically encountered in Mississippi will be evaluated for these parameters.

Progress:

Requisite laboratory equipment was procured for determining PCC coefficient of thermal expansion, elastic modulus, shrinkage and tensile strength. Initiated testing of PCC samples.

The FHWA Mobile Concrete Laboratory (MCL) was set up at the University of Mississippi and a workshop was conducted by the FHWA Office of Pavement Technology to introduce engineers to the new MEPDG rigid pavement design test protocols and design procedure. An interlaboratory comparison of test results was conducted with replicate samples tested in the University of Mississippi laboratory and the MCL.

Plans for FY 2006:

Complete PCC testing and write final report.

Cost Estimate for FY 2006 \$89,808

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 15	STATE STUDY NO: 178
TOTAL STUDY BUDGET: \$195,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/07
STUDY TITLE:	Cogongrass Inventory and Management
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	John Byrd

Objective:

MDOT is faced with the control and management of a very aggressive grass known as "Cogongrass" (*Imperata cylindrica*). Cogongrass is an invasive weed which continues to spread along MDOT right of ways, as well as to adjacent properties. Because it is so hardy, it colonizes on a site and quickly becomes the dominant vegetation. No other plant species can compete with the extensive root system. It is a threat to both the local plant community and the native wildlife because it displaces all native plant materials, resulting in a near sterile monoculture. Neither wild nor domestic animals can digest the leaf tissue because of the high silica content.

The proposed research will be a three-phase approach. A comprehensive inventory will be completed which identifies colony locations on a regional and then state wide basis. This inventory will also identify adjacent land uses and the level of threat the cogongrass poses to particular areas. From this information, a priority system will be developed which identifies the areas most in need of treatment. This treatment may be one of two types, management or eradication. Due to the extensive spread of this plant in south Mississippi, it will have to be managed in some areas while eradication efforts are conducted in the high need areas.

Progress:

During FY 05 eight populations of cogongrass along MDOT rights of way were selected and the boundaries and center point latitude and longitude coordinates determined. Aerial images of all populations were collected in the fall of 2004. Several long-term cogongrass management studies have been established. One study site is on the west bound right of way of highway 63 just north of Interstate 10, and other sites are located in Jackson, George and Hancock counties. These studies evaluate various management tactics such as application of various rates of glyphosate imazapyr and imazapic, which are herbicides for cogongrass control. Two studies were established to evaluate tank additives to enhance the activity of these herbicides. Another study was established to evaluate the potential to use a plant pathogen biocontrol agent along the right of way of highway 90 in Jackson County.

Plans for FY 2006:

Obtain additional aerial images of all populations. Perform image analyses using ArcView computer software to map and measure each population. Monitor effectiveness of various treatment approaches.

Cost Estimate for FY 2006 \$110,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 16	STATE STUDY NO: 179
TOTAL STUDY BUDGET: \$157,462	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/06
STUDY TITLE:	Portable FWD for In-Situ Subgrade Evaluation
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	K.P. George

Objective:

MDOT is implementing the mechanistic-empirical pavement design methodology developed under NCHRP 1-37A. In this design procedure the subgrade materials are characterized by resilient modulus (M_R) and Poisson's Ratio. The Department has already initiated a study to determine M_R values of typical Mississippi soils using the laboratory harmonized test procedure. This laboratory effort will result in the development of a materials library that will enable the estimation of a given subgrade M_R based soil classification.

In-situ testing of the completed subgrade provides a better method for estimating the subgrade M_R than laboratory testing. Bag samples of soil obtained from borrow pits may not adequately represent the soil that will be encountered in-place on the project site. The reconstitution of the bag sample material into a laboratory test specimen will not duplicate the soil structure, density and moisture content to that existing in the field. Given these considerations, performing tests on top of the in-place subgrade will provide an estimate of subgrade M_R that will better model this parameter for input into the new MEPDG thus resulting in a more reliable pavement design.

The PRIMA 100 is a portable falling weight deflectometer (PFWD) that can be used to perform in-situ testing of subgrade soils. It is carried and operated by one person at a fraction of the cost of a conventional trailer conveyed and hydraulically operated FWD. This study will evaluate the use of the PRIMA 100 to rapidly determine a design M_R value for a given subgrade as well as ascertain the variability of this soil property for use in a reliability-based pavement design.

Progress:

During FY 05 a portable falling weight deflectometer (PFWD) was purchased from Carl Bro in Denmark – the wireless version of the PRIMA 100. Soil profiles were obtained from MDOT. Thirteen 200-ft field test sections were selected and tested with the Department's Dynatest FWD, PRIMA 100 and nuclear gage. Soil samples were collected from these test sections and tested to determine soil classification and laboratory resilient modulus. Correction equations are being developed/evaluated to correct the in-situ soil modulus values obtained from the PRIMA 100 tests to laboratory

Progress (cont.):

resilient modulus values. Preliminary indications are that two equations are required, one for coarse grained soils and the other one for fine grained soils.

Plans for FY 2006:

Continue testing soil samples for soil classification and resilient modulus. Continue development/evaluation of modulus correction equations. A computer program will be developed to accept the PRIMA 100 data, in-situ density and moisture to derive a resilient modulus value for each test section. With this information, "uniform" sections will be established, assigning a "design resilient modulus" for each uniform section. This approach will be recommended for MDOT routine pavement design.

A final report will be written and submitted to MDOT.

Cost Estimate for FY 2006 \$157,462

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 17	STATE STUDY NO: 180
TOTAL STUDY BUDGET: \$90,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/08
STUDY TITLE:	Evaluation of Pavement Marking Materials
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Randy L. Battey

Objective:

Current MDOT policy requires that products to be used on construction and maintenance projects come from the Departmental "Approved Products List". Additionally in order for the Department to obtain Federal participation on projects, all products must have an approved equal (i.e. no sole source products).

Safety has long been a priority for MDOT and with that in mind the Department is constantly exploring methods and products that will improve visibility for motorists both at night and during wet conditions. In order to evaluate new striping materials, MDOT has received formal experimental feature approval (in accordance with 23 CFR 635.411(a)(3)) from the Mississippi Division Office of FHWA on the following four projects to date:

1. MS 304 from US 61 to I-55 and Spur (MS 713), Desoto & Tunica Counties
2. US 49 from US 98 South to Black Creek, Forrest County
3. Interchange at US 61 and Liberty Road, Adams County
4. I-55 from Pearl Street to I-220, Hinds & Madison Counties

The performance of each of the experimental features incorporated in these projects (and any future approved pavement marking evaluations) will be separately documented and reported to interested agencies as well as the AASHTO Product Evaluation Listing (APEL) through technology transfer procedures already in place within MDOT's Research Division. This study will fund the collection and dissemination of data resulting from these evaluations. Additionally should these evaluations prove to be successful it will enable the approval of more products for the Departmental "Approved Product List" and enable Federal participation on more projects utilizing these products.

Cost Estimate for FY 2006 \$30,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 18	STATE STUDY NO: 181
TOTAL STUDY BUDGET: \$100,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/07
STUDY TITLE:	Structural Characterization of Asphalt Drainage Course Layers
RESEARCH AGENCY:	Burns, Cooley & Dennis, Inc.
PRINCIPAL INVESTIGATOR:	L. Allen Cooley, Jr.

Objective:

Asphalt Drainage Courses (ADCs) are generally required under all 4-lane facility flexible pavements in Mississippi. Within typical pavement sections, ADCs are placed over a stabilized granular soil base layer. MDOT is currently funding studies to implement the new Mechanistic-Empirical Pavement Design Guide (MEPDG). Within this new design guide all layers of the pavement structure are evaluated for fundamental engineering properties such as modulus and Poisson's Ratio. The proposed study includes three objectives:

1. Properly characterize the stiffness (modulus) of ADC materials.
2. Develop appropriate transfer functions for ADC materials. MDOT uses the Falling Weight Deflectometer (FWD) to characterize the structural capacity of in-place pavements that are scheduled for overlay. Data developed from FWD testing is input into ELMOD 5 for evaluating determining required thickness of overlay. To facilitate analysis using ELMOD 5 typical moduli values of ADC materials (objective 1) are required along with appropriate transfer functions.
3. The current MDOT flexible pavement design procedure does not assign a structural value (layer coefficient) to ADCs. The new MEPDG allows the contribution of the 4 inches of asphalt binder stabilized aggregates to the overall structural integrity of the pavement. Possible elimination of the underlying chemically stabilized soil base course could be realized if the drainage layer is shown to be structurally equivalent to the stabilized base layer, leading to a savings in pavement construction. The results from the first two objectives will be used in the MEPDG to perform this evaluation.

Cost Estimate for FY 2006 \$50,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 19	STATE STUDY NO: 182
TOTAL STUDY BUDGET: \$65,240	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/06
STUDY TITLE:	Ground Penetrating Radar Study – Phase I (Technology Review and Evaluation)
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	Waheed Uddin

Objective:

This project will review ground penetrating radar (GPR) equipment and data interpretation methodologies used for nondestructive determination of pavement layer thickness values. MDOT is planning to evaluate this technology together with the nondestructive falling weight deflectometer (FWD) tests to enhance the evaluation of asphalt highway pavements. Based on favorable assessment in Phase I study, a follow up larger Phase II study will be pursued for field evaluation of the candidate GPR technology on selected asphalt highway pavement sections. Upon successful results and validation of improved pavement evaluation and resulting potential cost savings, the MDOT will implement the technology for routine use.

Cost Estimate for FY 2006 \$65,240

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 20	STATE STUDY NO: 183
TOTAL STUDY BUDGET: \$60,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/08
STUDY TITLE:	Enhancing Mobility to Improve the Quality of Life in the Mississippi Capitol Region
RESEARCH AGENCY:	Jackson State University
PRINCIPAL INVESTIGATOR:	Emmett Crockett

Objective:

Jackson State University (JSU) has established an initiative entitled the University and Urban Mobility Initiatives to continuously assess mobility in the Greater Capitol Region and design and implement strategies to better ensure ease of movement throughout the metro area. This program will identify the regions strengths and shortcomings in the areas of transportation and mobility with the goals of continuing to maintain residents and viable commercial entities. The proposal provides for joint funding by JSU, MDOT and the City of Jackson to accomplish these goals. A budget of \$205,630 is proposed for the first year with JSU providing 42%, and MDOT and the City of Jackson respectively providing 29 percent of the cost of the program.

Funding for the project is contingent on the following two requirements:

1. The City of Jackson (or additional partners) agrees to contribute 29% of the total program cost.
2. The second contingency is that some type of deliverable by JSU be included in the project. This deliverable should include some reporting mechanism that provides some substantive information on the needs, progress and next steps in the form of a synthesis or report at defined intervals of work.

Cost Estimate for FY 2006 \$60,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 21	STATE STUDY NO: 184
TOTAL STUDY BUDGET: \$218,224	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/14
STUDY TITLE:	Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking
RESEARCH AGENCY:	Jackson State University
PRINCIPAL INVESTIGATOR:	Farshad Amini

Objective:

The conclusions and recommendations from Phase I State Study No. 174, Potential Applications of Paving Fabrics to Reduce Reflective Cracking, substantiated the development of this project. The primary objective is to conduct long-term monitoring of the performance of a flexible pavement which includes a paving fabric between the in-situ pavement and an HMA overlay. A comprehensive testing, monitoring, and analysis program is proposed, where twelve 500-ft pavement test sections are constructed on an existing two-lane highway, and then monitored for seven years. Particular attention is directed towards investigating the influence of overlay thickness on long-term performance. A comparison between the performance of paving fabric treatment systems for milled and non-milled surfaces, as well as a comparison between the performance of paving fabrics on sealed and non-sealed surfaces will be reported. In addition, a cost-benefit analysis will be performed to develop total life cycle costs for each section. This project, by accomplishing the above objectives, will provide a fundamental understanding of the behavior of paving fabric systems to reduce reflective cracking, and will offer practicing engineers a valuable alternative for more effective schemes during pavement rehabilitation strategies.

Cost Estimate for FY 2006 \$31,200

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 22	STATE STUDY NO: 185
TOTAL STUDY BUDGET: \$30,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/14
STUDY TITLE:	In-House Support to State Study No. 184 - Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William Barstis

Objective:

This study will be conducted to support the proposed study "Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking." The required tasks include:

1. FWD field testing and evaluation of requisite overlay of proposed pavement for inclusion in Phase II study.
2. Operation of the MDOT profiler to obtain video images of the pavement surface one time prior to construction of the twelve test sections and nine times subsequent to construction.
3. Mapping of cracks on the video logs for submission to Jackson State University.
4. Traffic control will be required to facilitate FWD testing by MDOT and pavement coring operations by Burns, Cooley, & Dennis, Inc.
5. Review of one construction report, three progress reports, and one final report.

Cost Estimate for FY 2006 \$9,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 23	STATE STUDY NO: 186
TOTAL STUDY BUDGET: \$20,400	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/14
STUDY TITLE:	Consultant Support to State Study No. 184 - Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking
RESEARCH AGENCY:	Burns, Cooley, Dennis, Inc.
PRINCIPAL INVESTIGATOR:	Randy Ahlrich

Objective:

This project will provide consultant support to the proposed study "Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking." The required tasks include:

1. Provide guidance on selection of paving fabric.
2. Provide guidance regarding paving fabric construction for inclusion in construction bid documents.
3. Monitor construction of test sections.
4. Perform requisite coring of pavement test sections.
5. Review the construction report, three progress reports and the final report.

Cost Estimate for FY 2006 \$10,200

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 24	STATE STUDY NO: 187
TOTAL STUDY BUDGET: \$53,538	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/06
STUDY TITLE:	Effect of Moisture Content on the Thermal Coefficient of Expansion of Concrete
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	Ahmed Al-Ostaz

Objective:

Portland cement concrete experiences a change in volume due to a change in temperature, and this dependency is described in terms of coefficient of thermal expansion (CTE). A test method to test the CTE of concrete was recently developed by AASHTO as test number TP60-00, "Standard Test Method for the Coefficient of Thermal Expansion of Hydraulic Cement Concrete." This method has been recommended and adopted by FHWA as an input in the new Mechanistic-Empirical Pavement Design Guide. However, the method suggests that the concrete is fully saturated in all occasions which is, generally speaking, not true. In this study the effect of moisture content on the CTE of concrete will be evaluated and the results correlated to the type of aggregate used in the mix.

Cost Estimate for FY 2006 \$53,538

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 25	STATE STUDY NO: 188
TOTAL STUDY BUDGET: \$174,997	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/07
STUDY TITLE:	Development of Mississippi DOT's Advanced Traffic Loading Analysis System (MS-ATLAS) to Support MEPDG Implementation
RESEARCH AGENCY:	ERES Consultants Division of ARA, Inc.
PRINCIPAL INVESTIGATOR:	

Objective:

The current MDOT flexible pavement design method utilizes 4 input values: AADT, % Trucks, ESALS for 10 or 20 year, and Flexible factor. The new Mechanistic-Empirical Pavement Design Guide utilizes a significant amount of additional traffic information in the form of load spectra to support a given pavement design. SS No. 165 "Traffic Load Spectra Development for the 2002 AASHTO Design Guide" included the following recommendation:

"Use of automated software that processes, checks, analyzes and prepares traffic data in the format required for input into the design guide would greatly reduce time and result in more accurate and efficient use of the guide. Manual processing of the large volume of traffic data can be accomplished, but will be labor intensive and subject to increased mistakes."

The objective of the current proposed study is to utilize the existing ATLAS prototype software to develop and implement an automated custom software system for processing and analysis of MDOT traffic data in support of the MEPDG implementation effort. In addition to the software, ARA will provide support in the form of technical documentation, user's guide, on-site software installation, and training.

Cost Estimate for FY 2006 \$87,500

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 26	STATE STUDY NO: 189
TOTAL STUDY BUDGET: \$15,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/07
STUDY TITLE:	Evaluation of the Effectiveness of Drainage Layers
RESEARCH AGENCY:	Mississippi Department of Transportation, Research Division & Mississippi State University
PRINCIPAL INVESTIGATOR:	Jordan Whittington

Objective:

MDOT currently is sponsoring a graduate student, Jordan Whittington, at Mississippi State University. In order to meet the thesis requirements for his Masters degree, Mr. Whittington will examine the effectiveness of and "value" that MDOT is realizing from providing positive drainage in pavement structures. Critics of the drainage layer claim that when not maintained the layers actually are a detriment to the pavement structure and due to this lack of maintenance, MDOT would be wise to omit the drainage layer in our new pavement designs. This project will support Mr. Whittington's research.

Cost Estimate for FY 2006 \$10,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 27	STATE STUDY NO: 190
TOTAL STUDY BUDGET: \$20,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/06
STUDY TITLE:	MDOT Research Program Peer Exchange
RESEARCH AGENCY:	Mississippi Department of Transportation, Research Division
PRINCIPAL INVESTIGATOR:	Randy L. Battey

Objective:

The State Planning and Research Program Administration regulations (23 CFR Part 420) became effective on August 22, 1994. Subpart B requires the States to conduct a peer exchange of their research and technology (R & T) management process on a periodic basis. Mississippi's first round peer exchange was held in June of 1998 and the second was held in September of 2002. The program is designed to send an outside team of invited top level managers to meet with the host agency to discuss and review its RD&T management processes. Information on the host agency and team members' RD&T policies and procedures are exchanged with the intent to improve the overall RD&T management process. Peer exchanges provide an opportunity for participants to share best practices and management innovations with each other. The information gathered from the exchange is presented to agency management.

An in-state University to be determined later will provide assistance to MDOT in conducting this required peer exchange program. Specifically, the University will be reimbursed for the following functions related to this line item:

- Organizing the Event
- Reimbursing the Peer Exchange Participants Travel Cost
- Providing Lodging, Meals and Meeting Space for the Participants
- Preparing and Distributing a Final Report
- Providing Ground Transportation for Participants

Cost Estimate for FY 2006 \$20,000

MISSISSIPPI SPR-1(46)
PART II

LINE ITEM NO. 28	STATE STUDY NO: N/A
TOTAL STUDY BUDGET: \$25,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/05	COMPLETION DATE: 09/30/06
STUDY TITLE:	Minor Research Studies
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Randy L. Battey

Low cost/short duration projects may be done without being put into a process of clearances and competing with other programs. An example of such a project is an experimental feature evaluation.

The Research Advisory Committee will establish a resource threshold to be met before requiring any project be put into a centralized clearinghouse/priority setting process. Current operating procedures are to conduct research projects where the expenditure ceiling is expected to be under \$10,000 and the project duration is expected to be one year or less.

These are based on selection and approval by the Research Engineer, following an appropriate review of District needs and literature review.

These research projects are short-term, and will employ only MDOT personnel in the research project. Brief, concise work plans will be developed for each of these projects.

Cost Estimate for FY 2006 \$25,000

MISSISSIPPI SPR-1(46)
PART II

MISSISSIPPI PARTICIPATION IN NCHRP

The Mississippi Department of Transportation contributes to the National Cooperative Highway Research Program (NCHRP). NCHRP is a special-purpose program administered by the Transportation Research Board (TRB) under a three-way agreement among the National Academy of Sciences, AASHTO, and the FHWA. Funding is provided by state highway and transportation agencies at a rate of 5.5% of the agencies' SPR (both Part I & II) funds. Funds for this participation are 100% Federal and thus contain no state match. These pooled funds are used to fund research aimed at solving national or regional problems and can only be spent on problems approved by at least two-thirds of the states. Formal solicitations are made from the states, AASHTO committees, TRB committees and FHWA to develop problem statements. MDOT's annual contribution is paid for entirely utilizing SPR Part II funds even though the formula for determining the annual contribution is based on both Part I & II funding. Estimated contribution for FY 2006 is \$440,000.

MISSISSIPPI SPR-1(46)
PART II

TRANSPORTATION RESEARCH BOARD CORRELATION SERVICE

This service provides for subscription to a "Research Correlation Service" from the Transportation Research Board, a service established and operated in accordance with the recommendation of the Executive Committee of AASHTO. The activities supported by this subscription include the collection of available information concerning past, current and proposed research related to transportation from all sources including federal, state and other government agencies, colleges and universities, research and planning organizations, transport operators and industry, as well as the TRB Annual Meeting and conference programs; the study and correlation of this information through the work of the committees of the Board and dissemination of the useful findings of research and other information by all feasible means including the several TRB publication series, the output of the Transportation Information Services, and through personal contacts during scheduled field visits by the TRB professional staff. The FY 2006 TRB Correlation Service is funded for \$93,455, which corresponds to the current annual subscription cost for Mississippi.

Cost Estimate for FY 2006 \$93,455

POOLED FUND STUDIES

Pooled Fund Study: *Auburn University Accelerated Pavement Test Facility - Round 3*

Host Agency - Alabama Department of Transportation

The objective of this pooled-fund study is to construct, operate, and analyze the data from Mississippi's two new sections on the NCAT test track. At the time of this printing, mix designs for each of the sections have not been finalized. Ten states (Alabama, Florida, Georgia, Indiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, and Tennessee) are currently participating in this study that will evaluate hot mix asphalt pavement under a traffic loading of 10 million equivalent single axle load (ESALs) over a three year period. Each participating state was responsible for the pavement design for any new test sections. The National Center for Asphalt Technology (NCAT) will be responsible for monitoring the experiment to include periodic data collection and data analysis. The MDOT has committed to the third round of test section construction, trafficking and analysis. This commitment will be for fiscal years 2006 through 2008 in the following amounts:

FY 2006 - \$200,000 FY 2007 - \$200,000 FY 2008 - \$200,000

Pooled Fund Study: *Structural Improvement of Flexible Pavement Using GeoSynthetics for Base Course Reinforcement*

Host Agency - Maine Department of Transportation

High-modulus geogrids and geotextiles are being marketed as base course reinforcement to increase the structural capacity of flexible pavement sections constructed on weak subgrades. The AASHTO Task Force on Geogrid/Geotextile Specification is attempting to develop design standards for aggregate base course reinforcement; however, this effort is being hindered by the lack of field performance measurements for pavement sections designed for traffic loadings typical of state DOTs. This study will provide this missing data by constructing full-scale sections of pavement and underlying subgrade and then loading these pavements to failure using a Heavy Vehicle Simulator (HVS). Reinforced and unreinforced sections will be compared considering the effects of subgrade strength, aggregate base course thickness, pavement thickness, and frost action. A total of 32 sections will be tested with 8 sections tested per year. The study is estimated to cost \$2,120,000. MDOT will contribute a total of \$100,000 during the fiscal years 2002 through 2006.

FY 2002 - \$25,000 FY 2004 - \$25,000
FY 2005 - \$25,000 FY 2006 - \$25,000

Pooled Fund Study: ***Improving the Quality of Pavement Profiler Measurement***

Host Agency – FHWA

This pooled fund effort will provide agencies with information and first hand experience to address issues and concerns related to profiler operation, equipment, and procedures. There is an increasing need for State Highway Agencies to purchase and upgrade profiling equipment to provide network level and project specific smoothness information. This includes profilers operated at close to posted speed limits that are most often used to determine ride quality on a network level and smaller units, such as lightweight profilers (LWP). The project objectives include:

Deliver sample procurement specification, maintenance guidelines and profile analysis software program

Establish criteria for verification centers and assist with the development of these locations

Develop and deploy a traceable verification center

Provide technical review of software that locates surface imperfections that require corrective repair during construction, can relate the bumps to the highway users and procure for general distribution

The estimated total cost of this study is \$1,632,900. MDOT will contribute a total of \$120,000 during the fiscal years 2003 through 2006.

FY 2003 - \$30,000 FY 2004 - \$30,000 FY 2005 - \$30,000 FY 2006 - \$30,000

Pooled Fund Study: ***Construction of Crack-Free Concrete Bridge Decks***

Host Agency – Kansas Department of Transportation

The purpose of this study is to implement the most cost-effective techniques for improving bridge deck life through the reduction of cracking. The work will involve cooperation between cement companies, contractors and designers. The following tasks will be used to achieve this objective:

1. Develop a detailed plan to construct bridge decks with minimum cracking by incorporating “best practices” dealing with materials, construction procedures, and structural design.
2. Work with State DOT’s, designers, contractors, inspectors, and material suppliers to modify designs, specifications, contracting procedures, and structural design.
3. Select bridges to be constructed using “best practices,” and pre-qualify designers and contractors in application of the techniques. Twenty bridges, 10 in northeast Kansas and 10 in other participating states, will be constructed using the new techniques. Researchers from the University of Kansas and state DOT personnel will work closely with designers and contractors to achieve the desired results.
4. Carry out detailed crack surveys on the bridge decks, three months, six months, one year, two years, and three years after construction.
5. Correlate the cracking measured in Task 4 with the environmental and site conditions, construction techniques, design specifications and material properties and compare with earlier data. Similar data from participating states, where it exists, will be incorporated in the analysis.
6. Document the results of the study and prepare and disseminate a final report to participating states regarding the findings of Tasks 1-5.
7. Develop a training program, including a video produced by KDOT Support Services, to assist the participating states in implementing the findings of the study. The program will consist of workshops to be held at the representative state DOT offices. These workshops will be individually coordinated with each participating DOT.

MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2006.

FY 2003 - \$15,000 FY 2004 - \$15,000 FY 2005 - \$15,000 FY 2006 - \$15,000

Pooled Fund Study: ***Development of Geotechnical Procedures/Operations Manual***

Host Agency – FHWA

Currently, there are a number of State DOT's that have either outdated, incomplete or no procedures manuals for design, construction and inspection of geotechnical features (structural foundations, earth retaining structures and earthworks) for structures and roadways. This activity will develop a manual that provides detailed technical guidance on Geotechnical procedures and selection, management, quality, and cost control of products/services from Geotechnical consultants and drillers. The project will also include development of a web enabled template with an implementation plan and a user interface application that will allow State Departments of Transportation to adopt the manual in a form that is most suitable to their needs. The estimated total cost of this three-year study is \$275,000.

MDOT will contribute a total of \$15,000 during the fiscal years 2004 through 2006.

FY 2004 - \$5,000 FY 2005 - \$5,000 FY 2006 - \$5,000

Pooled Fund Study: ***Evaluation of the Safety Edge***

Host Agency – FHWA

The goal of the proposed pooled fund study is to evaluate the effectiveness of using the Safety Edge (edge wedge) to help prevent and reduce severity of pavement edge drop-off related crashes. A before and after evaluation (Emperical Bayes method) will be performed on sites with upcoming installations of the safety edge in the U.S. FHWA is spending a total of \$150,000 to support this project.

MDOT will contribute a total of \$45,000 during the fiscal years 2005 through 2007 to support this effort.

FY 2005 - \$15,000 FY 2006 - \$15,000 FY 2007 - \$15,000

Pooled Fund Study: ***Electronic Appraisal Development Study***

Host Agency – Texas DOT

The objective of the study is to develop and deliver a "How To" manual of instruction for the electronic transmittal of Real Estate appraisal documents (appraisals, data books, and review appraiser reports). The manual should describe alternative options for implementation, listing pros and cons to each alternative, with recommendations for each participating state agency regarding respective hardware and software requirements. The Sponsoring Agency extended the project termination date of this study to August 31, 2006. The estimated total project cost for this extended period of time is \$99,577.

FY 2004 - \$10,000 FY 2006 - \$10,000

Pooled Fund Study: ***Development of Performance Properties of Ternary Mixes***

Host Agency – Iowa DOT

The purpose of this research project is to make a comprehensive study of how supplementary cementitious materials (SCMs) such as fly ash, slag, and silica fume can be used to improve the performance of concrete mixtures. The total project budget is estimated at \$1.8 million. .

FY 2006 - \$15,000 FY 2007 - \$15,000 FY 2008 - \$15,000 FY 2009 - \$15,000
FY 2010 - \$15,000

Pooled Fund Study: ***Evaluation of Low Cost Safety Improvements***

Host Agency – FHWA

The goal of the proposed research is to develop reliable estimates of the safety effectiveness of safety improvements identified as strategies in the NCHRP Report 500 Guidebooks. The scope of this study is to conduct a research project of priority strategies from all of the NCHRP Report 500 Guidebooks. A target of 24 strategies totaling \$6 million over three years is planned, but this will vary depending on the level of support.

FY 2006 - \$30,000 FY 2007 - \$30,000 FY 2008 - \$30,000

Pooled Fund Study: ***AssetManager and Transportation Maintenance/Asset Management System (M/AMS) AASHTOWare Products***

Host Agency – AASHTO

AssetManager is both a network asset analyzer tool to provide analysis of investment versus performance across categories for the highway mode over the long term as well as a program tradeoff tool, which supports shorter-term program decisions. The M/AMS will advance the state of the practice of maintenance management and the connection between maintenance management and asset management. The objective of this proposed project is to develop a modular Maintenance/Asset Management System that will leverage information from Pontis and Trnsport.

FY 2006 - \$60,000

Pooled Fund Study: ***Accelerated Implementation of Intelligent Compaction Technology for Embankment Subgrade Soils, Aggregate Base and Asphalt Pavement Material***

Host Agency – FHWA

Currently used compaction equipment and processes can too often result in inadequate and/or non-uniform material density, which can contribute in short embankment and/or pavement service life. Compaction rollers with intelligent compaction (IC) capabilities have been developed and are routinely used in parts of Europe and Asia. The primary outcomes of this pooled fund project include the accelerated development of IC QC/QA specifications for subgrade soils, aggregate base and asphalt pavement materials and the development of an experienced and knowledgeable IC expertise base within pool fund participating state DOTs. The total cost of this study is \$350,000. .

FY 2006 - \$25,000 FY 2007 - \$25,000 FY 2008 - \$25,000

TECHNICAL AND EVALUATION PROJECT NO. TE-030
HIGH PERFORMANCE CONCRETE PAVEMENT
WORK ORDER NO. DTFH71-99-TE030-MS-12
(State Study No. 137)

TOTAL STUDY BUDGET: \$90,242	TOTAL STUDY COST TO DATE: \$72,675
DATE STARTED: 10/01/99	COMPLETION DATE: 09/30/06
STUDY TITLE:	Resin Modified Pavement Demonstration Project
RESEARCH AGENCY:	Mississippi Department of Transportation
PRINCIPAL INVESTIGATORS:	Randy L. Battey

Background:

Resin Modified Pavement (RMP) is a new composite paving material consisting of a thin layer (2 inches) of open graded hot mix asphalt (HMA) whose internal voids (approximately 30% voids) are filled with a latex rubber-modified portland cement grout. Some of the objectives that the RMP material was developed to address are:

- resist damage from rutting
- resist damage from fuel spillage
- easily to construct with conventional construction equipment
- require no joints
- have comparable life cycle costs with other rehabilitation methods.

Objective:

The objective of this project is to construct a demonstration RMP highway project and compare its performance with ultra-thin whitetopping (Portland cement concrete inlay) and polymer modified asphalt, for a period of five years. The proposed study will be constructed in an intersection with a HMA pavement with a history of rutting and a high traffic loading.

Progress:

Test sections involving the three subject pavements were constructed on US 72 in Corinth, Mississippi in the Spring of 2001. Pre and post construction data was collected on the condition of the sites. An interim (Construction) report has been completed and distributed to interested agencies. This report includes documentation of construction and condition data of these pavement sections.

The post-construction condition of the pavement sections was monitored.

Distress in the Ultra-Thin Whitetopping section forced MDOT to replace many of the panels in the fall of 2003.

Plans for FY 2006:

In addition to continued monitoring and documenting the condition of the pavement sections, the final report will be written.

Cost Estimate for FY 2006: \$10,000

100% State Funded Research for FY 06

LINE ITEM NO. N/A	STATE STUDY NO. 146
TOTAL STUDY BUDGET: \$170,000	TOTAL COST TO DATE: \$80,000 SP&R \$60,000 Non-SP&R \$140,000 Total
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/06
STUDY TITLE:	Updating Mississippi Flood Frequency Reports
RESEARCH AGENCY:	United States Geological Survey
PRINCIPAL INVESTIGATOR:	K. Van Wilson

Objective:

Knowledge of magnitude and frequency of floods is essential to the design of bridges, highway embankments, culverts, levees, dams, and other structures near streams. Effective flood-plain management and determination of flood insurance rates require accurate information on magnitude and frequency of floods.

The statewide flood-frequency reports by Landers and Wilson (1991) and Wilson and Landers (1991) provided estimates of magnitude and frequency of floods at gaging stations and provided techniques for estimating magnitudes and frequency of floods at ungaged sites in Mississippi. Observed annual peak-flow data collected through 1988 at 358 gaging stations were used in the analyses. Since the 1991 statewide flood-frequency reports, an additional 11 years of observed annual peak-flow data has become available and data have been collected on several large floods. Also, the 1991 regional flood-frequency equations were developed using generalized least-squares (GLS) regression (Stedinger and Tasker, 1985; and Tasker and Stedinger, 1989). GLS regression had and still has advantages over the ordinary least-squares and weighted least-squares regression, but since the 1991 reports, Tasker and Slade (1994) demonstrated that GLS regression coupled with a site-specific approach [referred to as "interactive" by Tasker and Slade (1994) and as "region-of-influence" by Hodge and Tasker (1995)] had smaller root-mean-square errors than the traditional geographic regional approach. Analyses of flood frequency using these additional data with a site-specific approach may substantially change and improve the accuracy of techniques for estimating magnitudes and frequencies of floods in Mississippi.

Estimated Costs:

The project will be done in cooperation with the MDOT, Research Division. The 6-year project will begin October 1, 2000, and will end September 30, 2006. The total estimated cost of the project is \$340,000 distributed over six Federal Fiscal years (October 1 to September 30) as follows:

	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>Total</u>
MDOT	\$20,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$170,000
USGS	<u>\$20,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$170,000</u>
Total	\$40,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$340,000

Note that MDOT utilized SP&R Part II monies to fund our FY 2001 – FY 2003 commitment to this project. FYs 2004 & 2005 were funded with 100% state funds.

Products:

Reports will be published that contain maximum known flood data, annual peak-flow data, flood-frequency estimated at gaging stations, and equations and (or) computer programs for estimating the magnitude and frequency of annual floods in Mississippi.

The reports will be provided in paper form (with a diskette or CD) and will also be made available in digital form on the Internet.

Cost Estimate for FY 2006 \$30,000 (Non-SP&R funds)

Mississippi
Department of Transportation
RESEARCH WORK PROGRAM
SPR-1(46), Part II
H56

For the Fiscal Period
October 1, 2005 to September 30, 2006



Prepared by the
Mississippi Department of Transportation
RESEARCH DIVISION

In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

**Mississippi
Department of Transportation**

**RESEARCH WORK PROGRAM
SPR-1(46), Part II
H56**

**For the Fiscal Period
October 1, 2005 to September 30, 2006**